

# Article

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## **Chewing lice of genus *Myrsidea* (Phthiraptera: Menoponidae) from Turdidae (Passeriformes) of Costa Rica, with descriptions of seven new species**

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### **Abstract**

A total of 166 individuals from 10 bird species belonging to the family Turdidae were examined for chewing lice in Costa Rica during 2004, 2009 and 2010. A total of 12 species of the louse genus *Myrsidea* were collected from 54 birds, including four previously named, seven new undescribed species, and one identified as *Myrsidea* sp. Names, descriptions and illustrations are given for the seven new species of *Myrsidea*. They and their type hosts are: *Myrsidea assimilis* sp. nov. ex *Turdus assimilis* (Cabanis, 1850), *M. cerrodelamuertensis* sp. nov. ex *Catharus gracilirostris* (Salvin, 1865), *M. hrabaki* sp. nov. ex *Myadestes melanops* (Salvin, 1865), *M. obsoleti* sp. nov. ex *Turdus obsoletus* (Lawrence, 1862), *M. quinchoi* sp. nov. ex *Catharus frantzii* (Cabanis, 1861), *M. tapanti* sp. nov. ex *Catharus fuscater* (Lafresnaye, 1845), and *M. tapetapersi* sp. nov. ex *Turdus nigrescens* (Cabanis, 1861). Records of four named and one unidentified species of *Myrsidea* from other Costa Rican thrushes are also given and discussed.

**Key words:** Amblycera, *Myrsidea*, new species, new host-louse associations, population dynamics, Turdidae, *Catharus*, *Myadestes*, *Turdus*, Costa Rica

### **Introduction**

In the Neotropical Region, there are at present 15 recognized species of the genus *Myrsidea* Waterston, 1915 (Clay 1966) from 16 passerine host species of the family Turdidae, as defined in Clements *et al.* (2011). Ten of them occur on 10 bird species belonging to the genus *Turdus*, and the other 5 species occur on 6 species of thrushes belonging to the genus *Catharus* (Price *et al.* 2003). Subsequently, Bueter *et al.* (2009) reported one undetermined species of *Myrsidea* from *Hylocichla mustelina* (Gmelin, 1789).

The aim of this paper is to follow up on our previous work (Kounek *et al.* 2011a, b) and present new data on the taxonomy and distribution of chewing lice of the genus *Myrsidea* found on passerines of the family Turdidae in Costa Rica, including the description of seven new species.

### **Material and methods**

We conducted fieldwork during 2004, 2009 and 2010 at seven study sites in Costa Rica. For detailed locations and methods of our chewing louse research, see Sychra *et al.* (2006) and Kounek *et al.* (2011a).

The taxonomy of the birds follows Clements *et al.* (2011). Identification of the chewing lice was based on Clay (1966), which also provided the diagnostic characters that define the genus *Myrsidea* from the Turdidae. Because these characters are common to all the *Myrsidea* species mentioned below, they will not be repeated in the species descriptions. Some of the samples studied for this paper, belonging to previously described species, differ from their original descriptions or redescriptions by setal counts and dimensions. In these cases, we present our data

TABLE 1. List of hosts and their lice recorded in this study.

Host species	P	E	Myrsidea species	♂	♀	Nymphs	Location
<b>Turidae</b>							
<i>Catharus aurantiirostris</i> (Hartlaub, 1850)	1	4	** <i>Myrsidea simplex</i> Ansari, 1956	2	2	2	Braulio Carrillo NP, Sector Barva
<< " " >>	3	3	** <i>Myrsidea simplex</i> Ansari, 1956	2	1	2	Zona Protectora Las Tablas
<i>Catharus frantzii</i> (Cabanis, 1861)	1	1	<i>Myrsidea quinchoi</i> sp. nov.	1	1	15	Tapanti NP, Sector Tapanti
<< " " >>	0	8	<i>Myrsidea simplex</i> Ansari, 1956	—	—	—	Braulio Carrillo NP, Sector Barva
<i>Catharus fuscaeter</i> (Lafresnaye, 1845)	1*	5	<i>Myrsidea simplex</i> Ansari, 1956	12	2	22	Tapanti NP, Sector Tapanti
<< " " >>	2	5	<i>Myrsidea tapanti</i> sp. nov.	34	10	40	Braulio Carrillo NP, Sector Barva
<i>Catharus gracilirostris</i> (Salvin, 1865)	6	8	<i>Myrsidea rohi</i> Ansari, 1956	6	3	7	Tapanti NP, Sector Tapanti
<< " " >>	7	12	<i>Myrsidea rohi</i> Ansari, 1956	20	18	32	Braulio Carrillo NP, Sector Barva
<< " " >>	1*	12	<i>Myrsidea cerrodelamuertensis</i> sp. nov.	6	3	10	Tapanti NP, Sector Cerro de la Muerte
<i>Catharus mexicanus</i> (Bonaparte, 1856)	1	1	** <i>Myrsidea simplex</i> Ansari, 1956	0	2	2	Rincon de la Vieja NP
<i>Myadestes melanops</i> (Salvin, 1865)	1	1	<i>Myrsidea hrabaki</i> sp. nov.	1	0	0	Rincon de la Vieja NP
<< " " >>	9	11	<i>Myrsidea hrabaki</i> sp. nov.	9	13	31	Tapanti NP, Sector Tapanti
<< " " >>	7	18	<i>Myrsidea hrabaki</i> sp. nov.	13	5	4	Braulio Carrillo NP, Sector Barva
<i>Turdus assimilis</i> (Cabanis, 1850)	3	10	<i>Myrsidea assimilis</i> sp. nov.	7	4	5	Zona Protectora Las Tablas
<< " " >>	0	3	—	—	—	—	Rincon de la Vieja NP
<i>Turdus grayi</i> (Bonaparte, 1838)	1	1	<i>Myrsidea antiqua</i> Ansari, 1956	4	8	4	Tapanti NP, Sector Tapanti
<< " " >>	0	1	—	—	—	—	Barbilla
<< " " >>	3	6	<i>Myrsidea carrikeri</i> (Eichler, 1943)	2	5	1	Braulio Carrillo NP, Sector Barva
<< " " >>	3	5	<i>Myrsidea carrikeri</i> (Eichler, 1943)	9	4	2	Zona Protectora Las Tablas
<i>Turdus nigrescens</i> (Cabanis, 1861)	3	17	<i>Myrsidea tapetapesi</i> sp. nov.	4	2	5	Tapanti NP, Sector Cerro de la Muerte
<i>Turdus obsOLEtus</i> (Lawrence, 1862)	1	1	<i>Myrsidea obsoleti</i> sp. nov.	2	3	11	Hitoy Cerere BR
<b>Totals</b>	<b>54</b>	<b>116</b>		<b>134</b>	<b>86</b>	<b>195</b>	

P = number of birds parasitized; E = number of birds examined; \* = only one species of *Myrsidea* was found on this bird; \*\* = new host-louse association.

together with those from the original descriptions or redescriptions, but setal counts and dimensions that are fully consistent with these descriptions are not repeated here.

In the following descriptions, all measurements are in millimeters. Abbreviations for dimensions are TW, temple width; HL, head length at midline; PW, prothorax width; MW, metathorax width; AW, abdomen width at level of segment IV; TL, total length; ANW, female anus width; GW, male genitalia width; GSL, genital sac sclerite length. The new species are attributed to the first two authors only. The type specimens of the new species described in this paper are deposited in the National Biodiversity Institute, Santo Domingo de Heredia, Costa Rica (INBio). Other material will be deposited in the Moravian Museum, Brno, Czech Republic (MMBC).

## Results

A total of 116 individuals of 10 bird species belonging to the family Turdidae were examined, with 54 of them (47%) parasitized by 12 species of *Myrsidea* (Table 1). Nine host-louse records represent seven new species which are described and named below. The remaining samples belong to four previously named species, and to one unidentified species given as *Myrsidea* sp.

Prevalences of *Myrsidea* species ranged between 5% and 65% (three cases where only one parasitized bird was examined are not included). A total of 415 lice were collected. Ranges of mean intensities and mean abundances were in the 3.7–6.6 and 0.6–4.3 respectively. In 78% of parasitized birds ( $n = 54$ ) the rate of infestation was very low (1–10 lice per bird). Infestations by 11–23 lice per bird were found in 10 birds (19%). The highest numbers of lice were found on two *Catharus fuscater* that harbored 36 individuals of *Myrsidea simplex* and 71 individuals of *Myrsidea tapanti*, respectively. The overall sex ratio of lice was male-biased (134 males versus 86 females;  $\chi^2 = 10.5$ ,  $P < 0.01$ ). The overall age ratio of lice was equal (220 adults versus 195 immatures;  $\chi^2 = 1.51$ ). Total prevalences, mean intensities, mean abundances, sex ratio and adult–nymph ratio of lice from bird species with more than 10 specimens examined are given in Table 2.

**TABLE 2.** Parasitological parameters, sex ratio and age ratio of chewing lice on thrushes (Turdidae) from Costa Rica (only bird species with more than 10 examined specimens are included).

Bird species / Louse species	Prevalence (%)	Mean intensity $\pm$ SE	Intensity range	Mean abundance $\pm$ SE	Percentage males (%) <sup>1</sup>	Percentage adults (%) <sup>2</sup>
<i>Catharus gracilirostris</i> (n = 20)						
<i>Myrsidea rohi</i>	65	6.6 $\pm$ 1.8	1–23	4.3 $\pm$ 1.4	55.3 (47)	54.7 (86)
<i>Myadestes melanops</i> (n = 30)						
<i>Myrsidea hrabaki</i>	57	4.5 $\pm$ 1.0	1–15	2.5 $\pm$ 0.7	56.1 (41)	53.9 (76)
<i>Turdus assimilis</i> (n = 13)						
<i>Myrsidea assimilis</i>	23	5.3 $\pm$ 3.1	1–13	1.2 $\pm$ 0.9	63.6 (11)	68.8 (16)
<i>Turdus grayi</i> (n = 13)						
<i>Myrsidea carrikeri</i>	46	3.8 $\pm$ 1.2	1–10	1.8 $\pm$ 0.8	55.0 (20)	87.0 (23)
<i>Turdus nigrescens</i> (n = 17)						
<i>Myrsidea tapetapersi</i>	18	3.7 $\pm$ 0.5	3–5	0.6 $\pm$ 0.3	66.7 (6)	54.5 (11)
<i>Turdidae</i> total (n = 116)	47	7.6 $\pm$ 1.5	1–71	3.6 $\pm$ 0.9	60.9 (220)	53.0 (415)

<sup>1</sup> = number of adults is in parentheses; <sup>2</sup> = number of lice for which age was assessed is in parentheses.

## Species descriptions

### *Myrsidea antiqua* Ansari, 1956

*Myrsidea antiqua* Ansari, 1956: *Pak. J. Health*, 5: 174, Figs 10a–h.

**Type host:** *Turdus grayi grayi* Bonaparte, 1838—Clay-colored Thrush.

**Material studied.** Three females and 2 males, ex *Turdus grayi*, COSTA RICA: Tapanti National Park, Sector Tapanti ( $09^{\circ}46'N$ ,  $83^{\circ}47'W$ ; 1200 m), 2 August 2009, Sychra and Literak leg. Deposited in INBio (O.Sychra CR184–185) and MMBC (O.Sychra CR183).

**Remarks.** Our specimens differ from the redescription of *M. antiqua* presented by Clay (1966) by setal counts and dimensions as follows [setal counts and dimensions mentioned by Clay (1966) are in parentheses]:

**Female (n = 3).** Tergal setae: I, 13–15 (14–16); II, 15–16 (18–20); III, 16–19 (19–23); V, 19–21 (20–24); VI, 17–20 (20–26); VII, 16–18 (17–21). Postspiracular setae extremely long, 0.51–0.52, on II, IV and VIII; very long, 0.35–0.43, on I and VII; long, 0.21–0.25, on III; and short, 0.13–0.16, on V and VI. Sternal setae: II, 12–13 (9–12) anterior setae; III, 27–31 (25–29); V, 38–40 (33–38); VI, 32–37 (28–32); VII, 13–14 (10–13); VIII–IX, 23–25 (26–30) including 13–15 setae on vulval margin. Dimensions: MW, 0.50–0.51 (0.45–0.50); ANW, 0.23–0.24; TL, 1.59–1.66 (1.62–1.74).

**Male (n = 2).** Tergal setae, with median gap in the row of setae on II–VIII: II, 14–17 (19–21); V, 18–20 (20–23); VI, 17–18 (19–21); VIII, 9 (11–13). Postspiracular setae extremely long, 0.51, on II, IV and VIII; long, 0.25–0.31, on I and VII; and short, 0.11–0.14, on III, V and VI. Sternal setae: VI, 30–32 (32–42); VII, 15–17 (16–18). Sternites III with 1–2 medioanterior setae. Dimensions: HL, 0.28–0.30 (0.30–0.33); PW, 0.28–0.30 (0.29–0.31); MW, 0.39–0.40 (0.36–0.39); TL, 1.30–1.31 (1.38–1.43); GW, 0.11–0.12; GSL, 0.09.

### *Myrsidea assimilis* Kounek and Sychra sp. nov.

(Figs 1–2, 11, 15)

**Type host:** *Turdus assimilis* (Cabanis, 1850)—White-throated Thrush

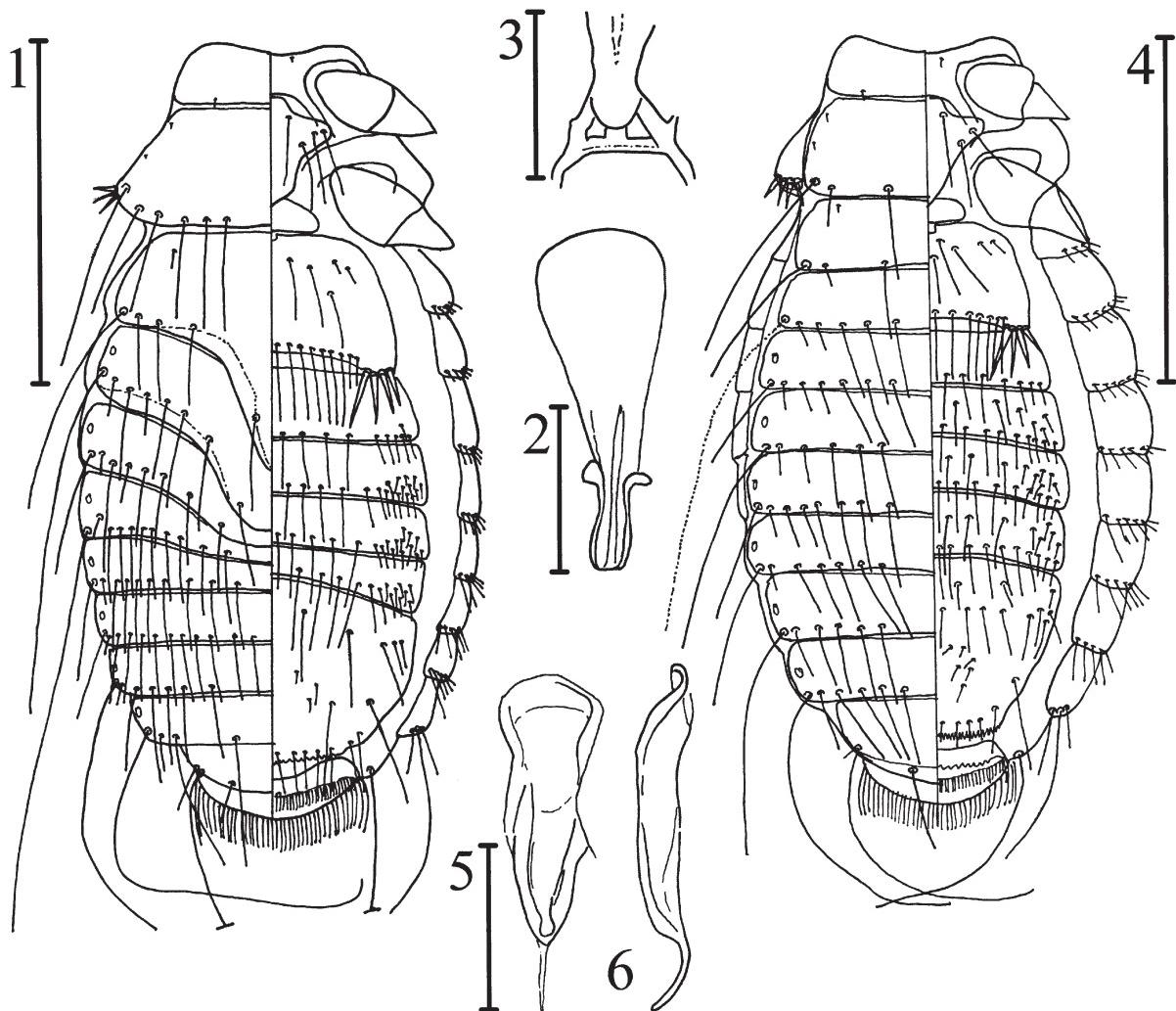
**Female (n = 3).** As in Fig. 11. This species belongs to the *thoracica* species group sensu Clay (1966). Length of dorsal head seta (DHS) 10, 0.060; DHS 11, 0.100–0.110; ratio DHS 10/11, 0.55–0.60. Gula 4–5 setae on each side. Metasternal plate with 6–7 setae; metanotum not enlarged, with 11–12 marginal setae. Femur III with 21–25 setae in ventral setal brush.

Abdomen with tergite I enlarged, with concave lateral margins and a conspicuously convex posterior margin, with medial portion shaped as a distal narrow process (Fig. 1); tergite II with concave lateral margins and a conspicuously convex posterior margin (Fig. 1); a wide median gap in each of the tergal setae rows on segments II–VIII. Tergal setae: I, 8–10; II, 13–15; III, 15–16; IV, 18–21; V, 19–23; VI, 17–21; VII, 12–15; VIII, 8–9. Postspiracular setae extremely long (0.53–0.60) on II, IV and VIII; very long (0.40–0.45) on VII; long (0.30) on I; and short (0.14–0.20) on III; V, VI. Sternal setae: II, 3–4 in each aster, 17–18 marginal setae between asters, 9 anterior; III, 23; IV, 35–37; V, 35–38; VI, 30–32; VII, 10; VIII–IX, 22–25 including 12–14 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternite VI slightly arched (Fig. 1). Anal fringe formed by 36–38 dorsal and 36–39 ventral setae. Dimensions: TW, 0.50–0.51; HL, 0.30–0.31; PW, 0.28–0.31; MW, 0.45–0.49; AW, 0.56–0.60; ANW, 0.23–0.24; TL, 1.50–1.56.

**Male (n = 4).** As in Fig. 15. Length of DHS 10, 0.060; DHS 11, 0.100–0.110; ratio DHS 10/11, 0.55–0.60. Metasternal plate with 6 setae; metanotum with 10–12 marginal setae.

Tergal setae with median gap on III–VIII tergite. Tergal setae: I, 11–12; II, 16–17; III, 17–20; IV, 19–21; V, 16–22; VI, 16–17; VII, 14–16; VIII, 8–9. Postspiracular setae extremely long (0.50–0.52) on II, IV and VIII; long (0.24–0.43) on I and VII; and short (0.13–0.18) on III, V and VI (one male with 0.23 long seta on one side of tergite VI). Sternal setae: II, 3–4 in each aster, 15–18 marginal setae between asters, 7–8 anterior; III, 22–23; IV, 35–40; V, 33–38; VI, 28–32; VII, 15–17; VIII, 7; without medioanterior setae on sternites III–VII. Genital sac sclerite swollen distally, with a subapical projection on each side, and a long darker medioposterior line (Fig. 2). Dimensions: TW, 0.44–0.46; HL, 0.29; PW, 0.28; MW, 0.38–0.39; AW, 0.47–0.48; TL, 1.26–1.33; GW, 0.11; GSL, 0.09–0.11.

**Type material.** Female holotype and paratype male (O.Sychra CR186) ex *Turdus assimilis*, COSTA RICA: Zona Protectora Las Tablas, La Amistad Lodge ( $8^{\circ}54'N$ ,  $82^{\circ}47'W$ ; 1300 m), 21 August 2010, Sychra and Literak leg. Paratypes: 1 female and 1 male (O.Sychra CR187) with the same data as holotype, both deposited in INBio (O.Sychra CR186–187) and 1 female and 2 males with the same data as holotype, deposited in MMBC (O.Sychra CR188–189).



**FIGURES 1–6.** 1–2, *Myrsidea assimilis*: 1, female dorsoventral mesothorax, metathorax and abdomen. 2, male genital sac sclerite. 3–6, *Myrsidea cerrodelamuertensis*: 3, hypopharyngeal sclerites. 4, female dorsoventral mesothorax, methathorax and abdomen. 5, male genital sac sclerite. 6, male genital sac sclerite distorted. Scale bars = 0.5 mm for all figures.

**Remarks.** Although Lindell *et al.* (2002) mentioned *Myrsidea* sp. from *T. assimilis*, this is the first species determination of a *Myrsidea* from this host. The female of *M. assimilis* sp. nov. is characterized by (1) the shape of tergites I–II (Fig. 1), (2) a wide median gap in rows of tergal setae on II–VIII (Fig. 1), and (3) a TW of at least 0.50. These characters place *M. assimilis* sp. nov. close to *M. varia* Ansari, 1956 (ex *Turdus ignobilis debilis* Hellmayr, 1902 from Peru), and *M. abidae* Ansari, 1956 (ex *T. fumigatus aquilonalis* (Cherrie, 1909) from Venezuela and the Republic of Guyana). However, the female of *M. assimilis* sp. nov. can easily be separated from that of *M. varia* by its smaller number of setae on tergite I (8–10 vs. 15) and larger number of setae on tergites IV–VII (in total 66–80 vs. 57), and from that of *M. abidae* by its smaller number of setae on sternites III–V (in total 93–98 vs. 109–120) and smaller dimensions, especially TW (0.50–0.51 vs. 0.54).

The male of *M. assimilis* sp. nov. differs from that of *M. varia* by its genital sac sclerite (compare Fig. 2 with fig. 73 in Clay 1966). Also, it is well characterized by the following additional features: (1) tergal chaetotaxy, and (2) sternites III–VII without anterior setae. These characters place the male of *M. assimilis* sp. nov. close to *M. indigenella* Ansari, 1956 (ex *Turdus maranonicus* Taczanowski, 1880 from Peru) and to *M. abidae* Ansari, 1956. However, the male of *M. assimilis* sp. nov. can be distinguished from that of *M. abidae* by its smaller number of setae on tergite VI (14–16 vs. 18–22) and sternite III (22–23 vs. 25–28) and from that of *M. indigenella* by its smaller number of setae on tergite I (11–12 vs. 14) and sternite VIII (7 vs. 10), and by larger number of setae on tergite IV (19–21 vs. 17) and tergite VII (14–16 vs. 13).

**Etymology.** The species name is a noun in apposition derived from the specific name of the type host.

## *Myrsidea carrikeri* Eichler, 1943

*Myrsidea carrikeri* Eichler, 1943: *Zool. Anz.*, 141: 59.

**Type host:** *Turdus grayi casius* (Bonaparte, 1855)—Clay-colored Thrush

**Material studied.** One male, ex *Turdus grayi*, COSTA RICA: Braulio Carrillo National Park, Sector Barva (10°07'N, 84°07'W; 2600 m), 1 August 2010, Literak and Sychra leg. Two females and 3 males. Zona Protectora Las Tablas, La Amistad Lodge (8°54'N, 82°47'W; 1300 m), 20–21 August 2010, Sychra and Literak leg. Deposited in INBio (O.Sychra CR190–191) and MMBC (O.Sychra CR192).

**Remarks.** Our specimens differ from the redescription of *M. carrikeri* presented by Clay (1966) by setal counts and dimensions as follows [setal counts and dimensions mentioned by Clay (1966) are in parentheses]:

**Female (n = 7).** Tergal setae: II, 19–23 (20–22); III, 28–29 (23–28); IV, 30–31 (25–29); V, 30–32 (26–31); VI, 29–32 (23–29); VII, 21–25 (19–24); VIII, 15–18 (14–16). Postspiracular setae extremely long, 0.55–0.60, on II, IV; very long, 0.42, on VIII; long, 0.25–0.30, on I, III and VII; and short, 0.13–0.20, on V and VI. Sternal setae: III, 35–37 (28); IV, 46–49 (36–42); V, 44–49 (42–48); VI, 36–40 (31–36); VII, 18–19 (16); VIII–IX, 29–31 (24–33) including 10–14 (12–16) setae on vulval margin. Dimensions: HL, 0.33–0.34 (0.34–0.36); PW, 0.32 (0.34–0.35); MW, 0.51–0.53 (0.50–0.51); ANW, 0.28–0.30; TL, 1.66–1.70 (1.79).

**Male (n = 4).** Tergal setae, without median gap in each row: V, 22–26 (23–28); VI, 23–28 (22–25). Postspiracular setae extremely long, 0.45–0.55, on II, IV and VIII; long, 0.32–0.39, on I and VII; and short, 0.11–0.17, on III, V and VI. Sternal setae: II, 15–18 (16) marginal setae, 13–17 (10–12) anterior setae; III, 29–35 (28–31); V, 40–46 (37–39); VI, 37–41 (33–37); VII, 22–24 (19–20); IX, 12–13 (8–11); sternites III–VII without medioanterior setae. Dimensions: HL, 0.28–0.30 (0.30–0.33); PW, 0.28 (0.29–0.31); MW, 0.38–0.40 (0.36–0.38); AW, 0.51–0.53 (0.50); TL, 1.38–1.40 (1.43); GW, 0.11–0.12; GSL, 0.09.

## *Myrsidea cerrodelamuertensis* Kounek and Sychra sp. nov.

(Figs 3–6, 12, 16)

**Type host:** *Catharus gracilirostris* (Salvin, 1865) – Black-billed Nightingale-Thrush

**Female (n = 3).** As in Fig. 12. Hypopharyngeal sclerites weakly developed (Fig. 3). Length of DHS 10, 0.050; DHS 11, 0.100; ratio DHS 10/11, 0.50. Gula 4 setae on each side. Metasternal plate with 6 setae; metanotum not enlarged, with 6–7 marginal setae. Femur III with 13–15 setae in ventral setal brush.

Tergites not enlarged, with straight posterior margins (Fig. 4). Tergal setae, with median gap in each row: I, 6; II, 12; III, 14–15; IV, 14; V, 13–15; VI, 14; VII, 13; VIII, 11–12. Postspiracular setae very long (0.40) on II, IV and VIII; long (0.30) on VII; and short (0.15–0.18) on I, III and V; VI (0.19–0.21). Sternal setae: II, 4 in each aster, 12–14 marginal setae between asters, 5–6 anterior; III, 14–16; IV, 30–32; V, 37–41; VI, 31–32; VII, 21–24; VIII–IX, 20–24 including 9–10 setae on deeply serrated vulval margin; with medioanterior setae on sternites: IV, 3–6; V, 6; VI, 5–6; VII, 4–5. Sternites not arched (Fig. 4). Anal fringe formed by 29–30 dorsal and 24–27 ventral setae. Dimensions: TW, 0.42–0.43; HL, 0.28–0.29; PW, 0.25–0.26; MW, 0.41–0.43; AW, 0.58–0.60; ANW, 0.21–0.23; TL, 1.48–1.60.

**Male (n = 3).** As in Fig. 16. Length of DHS 10, 0.045–0.050; DHS 11, 0.105; ratio DHS 10/11, 0.43–0.48. Metasternal plate with 5–6 and metanotum with 6 marginal setae.

Tergal setae with median gap in each row: I, 6; II, 9–10; III, 10–11; IV, 12–13; V, 14–15; VI, 11–12; VII, 13; VIII, 9–11. Sternal setae: 3–4 in each aster, 11 marginal setae between asters, II, 7 anterior; III, 10–14; IV, 26–28; V, 30; VI, 25–32; VII, 16; VIII, 10; with medioanterior setae on sternites: IV, 2–3; V 4–5; VI 3–4; VII 3–4. Genital sac sclerite of characteristic shape (Figs 5–6) and unlike those of other *Myrsidea* from the Turdidae. Dimensions: TW, 0.38–0.39; HL, 0.26; PW, 0.23–0.24; MW, 0.33–0.34; AW, 0.45–0.48; TL, 1.22–1.24; GW, 0.11–0.12; GSL, 0.10–0.11.

**Type material.** Holotype female and paratype male (O.Sychra CR193), ex *Catharus gracilirostris* COSTA RICA: Tapanti National Park, Sector Cerro de la Muerte (9°33'N, 83°43'W; 3100 m), 13 August 2010, Sychra and Literak leg. Paratypes: 2 females and 2 males (O.Sychra CR194–195), with the same data as holotype. Deposited in INBio.

**Remarks.** *Myrsidea cerrodelamuertensis* sp. nov. is the second species of this louse genus recorded from *Catharus gracilirostris*. It differs greatly from *M. rohi* — described by Ansari (1956) from the same host but at a different location in Costa Rica — by its reduced hypopharyngeal sclerites (Fig. 3). This character places *M. cerrodelamuertensis* sp. nov. close to *M. sultapurensis* Ansari, 1951 from *Myophonus caeruleus* (Scopoli, 1786) from Pakistan and Afghanistan. However, both sexes of *M. cerrodelamuertensis* sp. can easily be distinguished from that species by: (1) absence of setae on sternite I, (2) presence of anterior setae on sternites IV–VII, and (3) smaller number of setae on metanotum (6–7 vs. 10–14). The male is also well-separated from those of other *Myrsidea* from the Turdidae by its unique genital sac sclerite (Fig. 5).

**Etymology.** The species epithet derives from the name of the type locality of this new louse species, the mountain Cerro de la Muerte (Death Mountain in Spanish).

### ***Myrsidea hrabaki* Sychra and Kounek sp. nov.**

(Figs 7–8, 13, 17)

**Type host:** *Myadestes melanops* (Salvin, 1865) – Black-faced Solitaire

**Female (n = 5).** As in Fig. 13. This species belongs to the *thoracica* species group sensu Clay (1966), except for the male genitalia sac sclerite, see below. Length of DHS 10, 0.040–0.045; DHS 11, 0.105–0.115; ratio DHS 10/11, 0.35–0.43. Gula 4–5 setae on each side. Metasternal plate with 7 setae; metanotum not enlarged, with 6 marginal setae. Femur III with 19–21 setae in ventral setal brush.

Abdomen with tergites not enlarged. Tergite I with straight posterior margin, II–III with slight medioposterior convexity (Fig. 7). Tergal setae, with median gap in each row: I, 13–15; II, 15–17; III, 15–17; IV, 14–17; V, 17; VI, 16–18; VII, 10–14; VIII, 8–10. Postspiracular setae extremely long (0.51–0.53) on II, IV and VIII; very long (0.35–0.38) on I and VII; long (0.28) on III; and somewhat shorter (0.18–0.21) on V, VI. Sternal setae: II, 4 in each aster, 12–14 marginal setae between asters, 4–6 anterior; III, 23–27; IV, 36–39; V, 40–44; VI, 33–35; VII, 13–18; VIII–IX, 21 including 9–11 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternites not arched (Fig. 7). Anal fringe formed by 26–32 dorsal and 31–33 ventral setae. Dimensions: TW, 0.48–0.49; HL, 0.30–0.31; PW, 0.29–0.30; MW, 0.40–0.45; AW, 0.56–0.59; ANW, 0.20–0.22; TL, 1.42–1.49.

**Male (n = 5).** As in Fig. 17. Length of DHS 10, 0.035–0.040; DHS 11, 0.090–0.105; ratio DHS 10/11, 0.38–0.39. Gula 4 setae on each side. Metasternal plate with 6 setae; metanotal marginal setae 6.

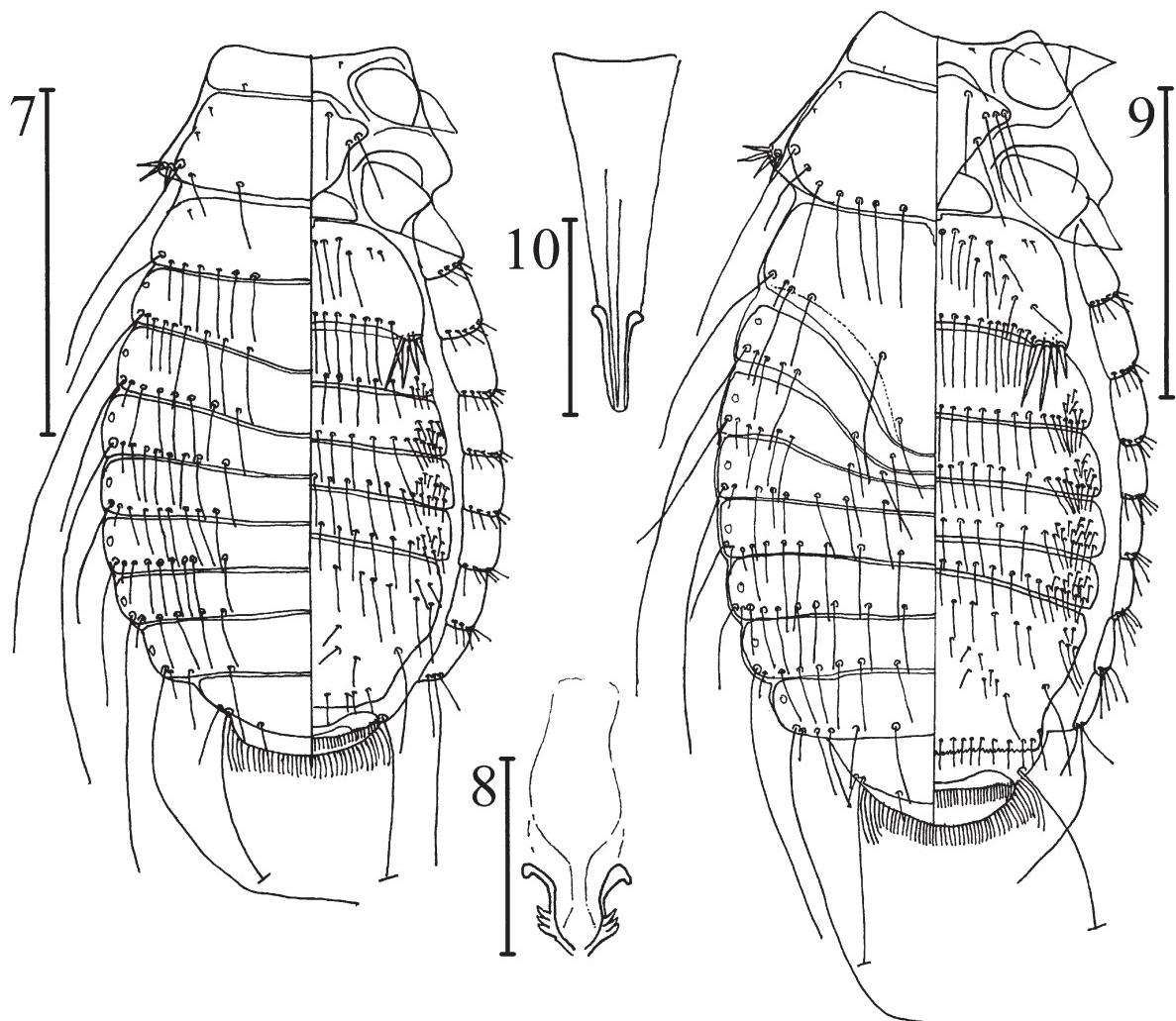
Tergal setae with median gap in each row: I, 14–15; II, 15; III, 14–16; IV, 16; V, 16; VI, 13–14; VII, 10–11; VIII, 8–9. Postspiracular setae extremely long (0.45–0.50) on II, IV and VIII; long (0.30) on I and VII; and short (0.13–0.18) on III, V, VI. Sternal setae: II, 12–14 marginal setae between asters, 4–5 anterior; III, 23–24; IV, 36–37; V, 39–42; VI, 31–32; VII, 16–18; VIII, 5–6. Genital sac sclerite as in Fig. 8. Dimensions: TW, 0.43–0.44; HL, 0.27; PW, 0.26–0.27; MW, 0.36–0.37; AW, 0.47; TL, 1.26; GW, 0.11–0.13; GSL, 0.08–0.09.

**Type material.** Holotype female and 2 paratype males (O.Sychra CR196), ex *Myadestes melanops*, COSTA RICA: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 7 August 2009, Literak and Sychra leg. Paratypes: 3 females and 1 male (O.Sychra CR197–198) with the same data as holotype; 3 females and 2 male (O.Sychra CR199–200), ex *Myadestes melanops*, COSTA RICA: Braulio Carrillo National Park, Sector Barva (10°07'N, 84°07'W; 2600 m), 2–8 August 2010, Sychra and Literak leg. Deposited in INBio.

**Remarks.** This is the first record of a chewing louse from *Myadestes melanops*. The female of *M. hrabaki* sp. nov. is characterized by the following: (1) Tergite I with straight posterior margin, (2) tergites II–III with slight medioposterior convexity (Fig. 7), (3) metanotum with only 6 setae, and (4) sternites III–VII not arched and without anterior setae (Fig. 7).

Although the male features of *M. hrabaki* sp. nov. agree with the *thoracica* species group sensu Clay (1966), it differs by its genital sac sclerite (Fig. 8), which is of the same type as that of *M. ishizawai* Uchida, 1926 from *Zoothera dauma* (Latham, 1790) from Japan. Nevertheless, characters of *M. hrabaki* agreeing with the *thoracica* species group—i.e. (1) number of outer dorsolateral setae of first tibia under 10, and (2) post-spiracular seta III markedly shorter than II—distinguish the male of *M. hrabaki* sp. nov. from that of *M. ishizawai*.

**Etymology.** This species is named *in memoriam* of Professor Rudolf Hrabak, our colleague and friend, in recognition of his friendship and unmatched enthusiasm in the study of biology and entomology.



**FIGURES 7–10.** 7–8, *Myrsidea hrabaki*: 7, female dorsoventral mesothorax, methathorax and abdomen. 8, male genital sac sclerite. 9–10, *Myrsidea obsoleti*: 9, female dorsoventral mesothorax, methathorax and abdomen. 10, male genital sac sclerite. Scale bars = 0.5 mm for all figures.

***Myrsidea obsoleti* Sychra and Kounek sp. nov.**  
(Figs 9–10, 14, 18)

**Type host:** *Turdus oboletus* (Lawrence, 1862)—Pale-vented Thrush

**Female (n = 3).** As in Fig. 14. This species belongs to the *carrikeri* species group sensu Clay (1966). Very pale species, almost without pigmentation (Fig. 14). Length of DHS 10, 0.060–0.065; DHS 11, 0.105–0.125; ratio DHS 10/11, 0.48–0.62. Gula 5–7 setae on each side. Metasternal plate with 10–12 setae; metanotum not enlarged, with 13–15 marginal setae. Femur III with 26–32 setae in ventral setal brush.

Tergite I enlarged with conspicuously convex posterior margin. Tergites II–III compressed by enlarged tergite I, and with convex posterior margin as in Fig. 9. Tergal setae with median gap in each row: I, 10–13; II, 12–15; III, 15; IV, 15–17; V, 18–21; VI, 18–21; VII, 16; VIII 12. Postspiracular setae extremely long (0.45–0.55) on II, IV, VII and VIII; long (0.23–0.25) on I and III; and short (0.11–0.14) on V and VI. Sternal setae: II, 4 in each aster, 13–18 marginal setae between asters, 19–22 anterior; III, 25–35; IV, 37–45; V, 37–45; VI, 32–37; VII, 16–18; VIII–IX, 29–32 including 15–17 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternite VI slightly arched (Fig. 9). Genital chamber without conspicuous comb-like projections of the inner surface (Fig. 23 vs. fig. 24 in Clay 1966). Anal fringe formed by 30–34 dorsal and 38–42 ventral setae. Dimensions: TW, 0.55–0.56; HL, 0.34; PW, 0.34–0.35; MW, 0.52–0.55; AW, 0.67–0.69; ANW, 0.25–0.26; TL, 1.68–1.74.



11



12



13



14

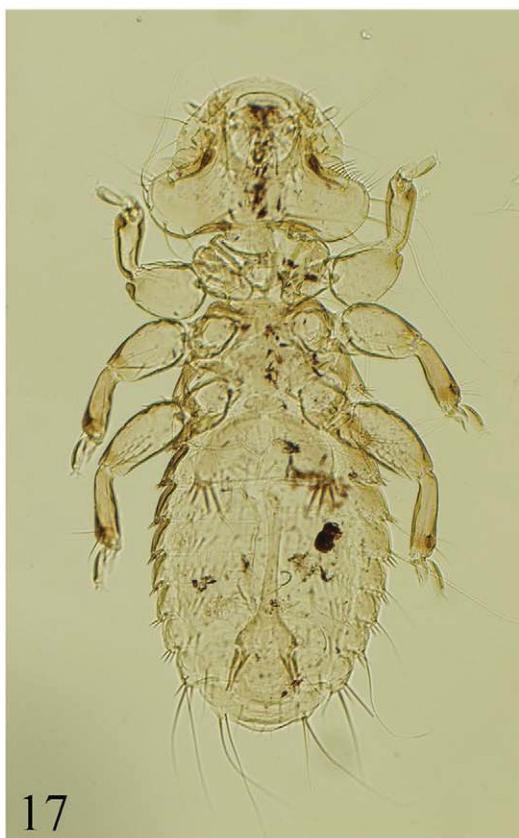
**FIGURES 11–14.** Holotype females: 11, *Myrsidea assimilis*. 12, *Myrsidea cerrodelamuertensis*. 13, *Myrsidea hrabaki*. 14, *Myrsidea obsoleti*.



15



16



17



18

**FIGURES 15–18.** Paratype males: 15, *Myrsidea assimilis*. 16, *Myrsidea cerrodelamuertensis*. 17, *Myrsidea hrabaki*. 18, *Myrsidea obsoleti*.

**Male (n = 2).** As in Fig. 18. Length of DHS 10, 0.060; DHS 11, 0.110; ratio DHS 10/11, 0.55. Gula with 5–6 setae on each side. Metasternal plate with 8–9 setae, metanotum with 13 marginal setae.

Tergal setae: I, 13–14; II, 16; III, 17–19; IV, 19–21; V, 17–19; VI, 18; VII, 15–17; VIII, 10–11. Postspiracular setae extremely long (0.55) on IV; very long (0.32) on I; and short (0.11–0.17) on III, V and VI (none on II, VII and VIII). Sternal setae: II, 4 in each aster, 14–16 marginal setae between asters, 14 anterior; III, 34; IV, 43; V, 42–44; VI, 40–41; VII, 23–25; VIII, 8–17; without medioanterior setae on sternites III–VII. Genital sac sclerite long and narrow with small subapical projection on each side and with long darker medioposterior line (Fig. 10). Dimensions: TW, 0.49; HL, 0.36; PW, 0.30–0.31; MW, 0.41–0.43; AW, 0.51–0.53; TL, 1.45–1.47; GW, 0.12–0.13; GSL, 0.10.

**Type material.** Holotype female and paratype male (O.Sychra CR202), ex *Turdus obsoletus*, COSTA RICA: Hitoy Cerere BR, Provincia Limón (9°40'N, 85°05'W), 22 August 2004, Literak leg. Paratypes: 2 females and 1 male (O.Sychra CR203) with the same data as holotype. Deposited in INBio.

**Remarks.** *Myrsidea obsoleti* sp. nov is the second species of *Myrsidea* from *Turdus obsoletus*. Nevertheless, characters of *M. obsoleti* agreeing with the *carrikeri* species group sensu Clay (1966) — i.e. (1) pronotum with 8 posterior setae, and (2) tergite I of female with median anterior emargination — distinguish *M. obsoleti* sp. nov. from *M. regius* described by Ansari (1956) from the same host at a different location in Costa Rica and belonged to the *thoracica* species group, i.e. it has (1) pronotum with 6 posterior setae, and (2) tergite I of female without median anterior emargination.

The female of *M. obsoleti* sp. nov. is characterized by the following: (1) genital chamber without conspicuous comb-like projections of the inner surface (see fig. 24 in Clay 1966), (2) tergites II–III compressed by enlarged tergite I with convex posterior margins, (3) smaller number of tergal setae, and (4) sternite VI slightly arched. These characters place *M. obsoleti* sp. nov. very close to *M. aitkeni* Clay, 1966 from *Turdus nudigenis nudigenis* (Lafresnaye, 1848) from Trinidad. However, the female of *M. obsoleti* sp. nov. can be distinguished from that of *M. aitkeni* by having median gaps in the rows of tergal setae, larger number of anterior setae on sternite II (19–22 vs. 9–12) and on sternite VII (16–18 vs. 10–13). Except for presence of median gaps in the rows of tergal setae, the male of *M. obsoleti* sp. nov. appears to be indistinguishable from that of *M. aitkeni*.

**Etymology.** The species name is a noun in apposition derived from the specific name of the type host.

#### *Myrsidea quinchoi* Kounek and Sychra sp. nov.

(Figs 19–20, 27, 31)

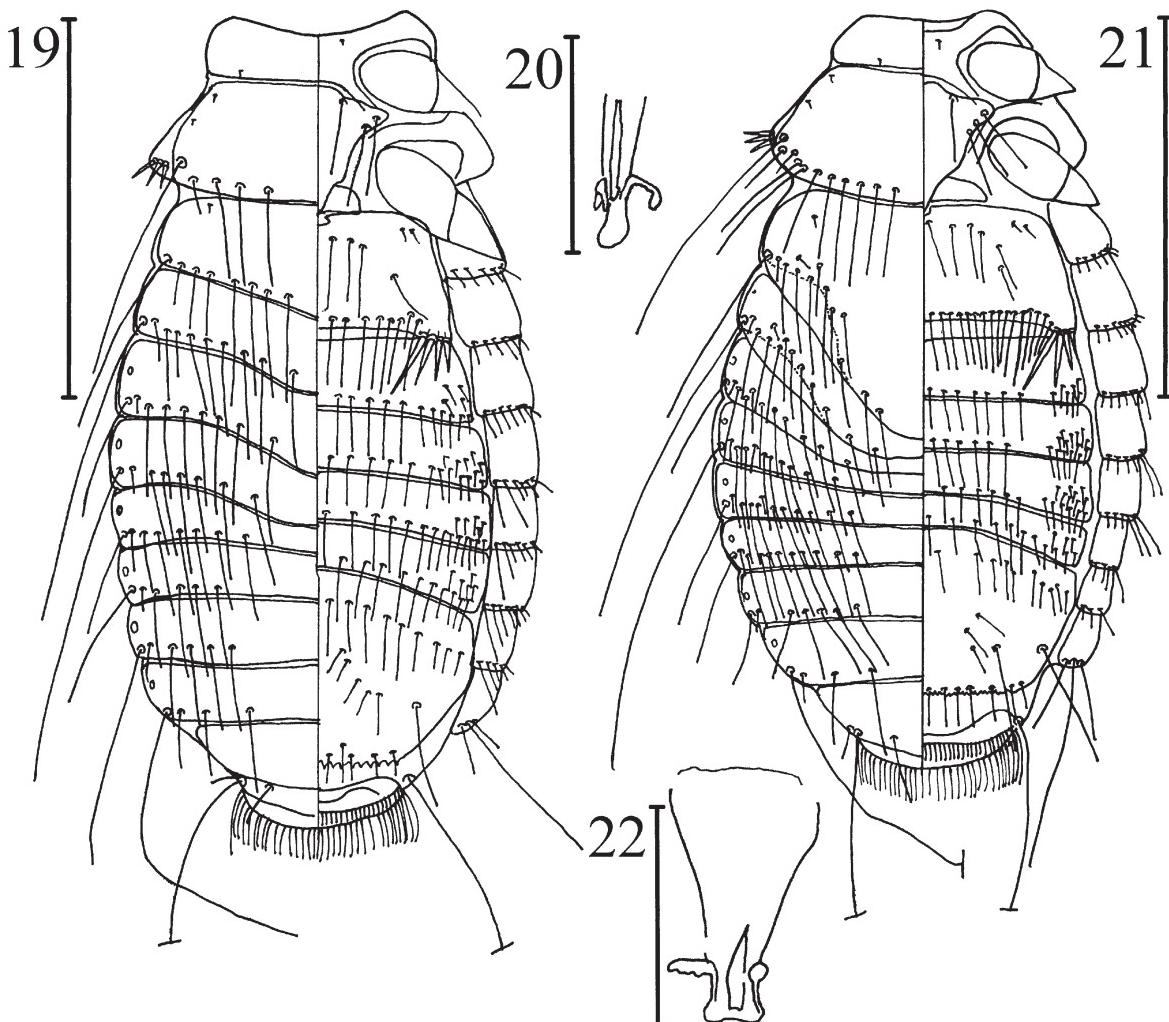
**Type host:** *Catharus frantzii* (Cabanis, 1861)—Ruddy-capped Nightingale-Thrush

**Female (n = 1).** As in Fig. 27. This species belongs to the *thoracica* species group sensu Clay (1966). Length of DHS 10, 0.050; DHS 11, 0.100; ratio DHS 10/11, 0.50. Gula 5 setae on each side. Metasternal plate with 6 setae; metanotum not enlarged, with 11 marginal setae. Femur III with 15 setae in ventral setal brush.

Tergites not enlarged. Tergites I–IV with medioposterior convexity as in Fig. 19. Tergal setae, with median gap in each row: I, 14; II, 19; III, 17; IV, 16; V, 16; VI, 12; VII, 12; VIII, 8. Postspiracular setae extremely long (0.45–0.48) on II, IV and VIII; long (0.25–0.30) on I and VII, and short (0.14–0.16) on III, V and VI. Sternal setae: II, 4 in each aster, 16 marginal setae between asters, 8 anterior; III, 29; IV, 35; V, 36; VI, 31; VII, 18; VIII–IX, 26 including 14 setae on serrated vulval margin (the number of setae on sternites VIII–IX is approximate, because they are clearly seen on one side only); without medioanterior setae on sternites III–VII. Sternite VI slightly arched (Fig. 19). Anal fringe formed by 30 dorsal as well as 30 ventral setae. Dimensions: TW, 0.45; HL, 0.30; PW, 0.28; MW, 0.45; AW, 0.57; ANW, 0.22; TL, 1.50.

**Male (n = 1).** As in Fig. 31. Length of DHS 10, 0.045; DHS 11, 0.090; ratio DHS 10/11, 0.50. Gula with 5 setae on each side. Metasternal plate with 6 setae, metanotum with 10 marginal setae.

Tergal setae, with median gap in each row: I, 11; II, 13; III, 14; IV, 16; V, 14; VI, 14; VII, 12; VIII, 8. Postspiracular setae extremely long (0.45–0.47) on II, IV and VIII; long (0.23–0.30) on I, III and VII; and short (0.14–0.16) on V and VI. Sternal setae: II, 3–4 in each aster, 14 marginal setae between asters, 7 anterior; III, 24; IV, 30; V, 28; VI, 26; VII, 16; VIII, 8; without medioanterior setae. Genital sac sclerite distorted with narrow lateral arms on each side and rounded posteriorly with darker medioposterior line (Fig. 20). Dimensions: TW, 0.40; HL, 0.29; PW, 0.26; MW, 0.37; AW, 0.45; TL, 1.27; GW, 0.11; GSL, at least 0.07 (distorted).



**FIGURES 19–22.** 19–20, *Myrsidea quinchoi*: 19, female dorsoventral mesothorax, methathorax and abdomen. 20, male genital sac sclerite. 21–22, *Myrsidea rohi* from Cerro de la Muerte (Tapanti NP): 21, female dorsoventral mesothorax, methathorax and abdomen. 22, male genital sac sclerite. Scale bars = 0.5 mm for all figures.

**Type material:** Holotype female and paratype male (O.Sychra CR201) ex *Catharus frantzii*, **COSTA RICA**: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 11 August 2009, Literak and Sychra leg. Deposited in INBio.

**Remarks.** This is the first record of chewing lice from *Catharus frantzii*. The female of *M. quinchoi sp. nov.* is easily distinguished from those of other *Myrsidea* from the Turdidae by the unique shape of tergites I–IV (Fig. 19) in combination with the following characters: (1) absence of anterior setae on sternites III–VII, (2) smaller number of tergal setae, and (3) smaller dimensions.

The male of *M. quinchoi sp. nov.* is well characterized by the following features: (1) genital sac sclerite, (2) tergal chaetotaxy (especially on tergite VII with more than 10 setae), and (3) sternites III–VII without anterior setae. These characters place *M. quinchoi sp. nov.* close to six species from thrushes of the genus *Turdus* (*M. abidae* Ansari, 1956, *M. assimilis* sp. nov., *M. indigenella* Ansari, 1956, *M. keniensis* Clay, 1966, *M. tapetapersi* sp. nov. and *M. regius* Ansari, 1956). However, the male of *M. quinchoi sp. nov.* can be distinguished from those of the aforementioned species by its smaller number of setae on tergites V+VI (28 vs. more than 31) and sternites V+VI (54 vs. more than 59), and smaller dimensions, especially TW (0.40 vs. more than 0.43).

**Etymology.** In recognition of his friendship, this species is named in honor of Joaquin Cortes Carrera („Ingeniero en sistemas informaticos“ from Jimenez de Pococi, Costa Rica), who is also known by his nickname Quincho.

## *Myrsidea rohi* Ansari, 1956

*Myrsidea rohi* Ansari, 1956: *Pak. J. Health*, 5: 170, Figs 6a–f.

**Type host:** *Catharus gracilirostris* (Salvin, 1865)—Black-billed Nightingale-Thrush

**Material studied.** Two females and 2 males (O.Sychra CR204–205), ex *Catharus gracilirostris* COSTA RICA: Braulio Carrillo National Park, Sector Barva ( $10^{\circ}07'N$ ,  $84^{\circ}07'W$ ; 2600 m), 31 July–7 August 2010, Sychra and Literak leg.; 5 females and 5 males (O.Sychra CR206–210), ex *Catharus gracilirostris* COSTA RICA: Tapanti National Park, Sector Cerro de la Muerte ( $9^{\circ}33'N$ ,  $83^{\circ}43'W$ ; 3100 m), 1–13 August 2010, Sychra and Literak leg. Deposited in INBio.

**Remarks.** Our specimens differ from the redescription of *M. rohi* presented by Clay (1966) by setal counts and dimensions. Furthermore, our specimens from Cerro de la Muerte (Tapanti NP) differ from those from Barva (Braulio Carrillo NP) as well as from those redescribed by Clay (1966) in the number of tergal setae and shape of tergites of the female. According to our knowledge of intraspecific variation in *Myrsidea* species (Clay, 1966), these differences could be used to separate these two populations into subspecies (see Palma & Price 2010), or even into species. However our preliminary results from molecular analyses of partial sequences of the mitochondrial COI gene do not support genetic distinctiveness of these two samples. Until final results of molecular analyses become available we suggest to consider the *Myrsidea* population from the *Catharus gracilirostris* of Cerro de la Muerte as conspecific with *M. rohi*.

**Descriptions of samples from separate localities.** [setal counts and dimensions mentioned by Clay (1966) are in parentheses].

### Braulio Carrillo NP, Sector Barva

**Female (n = 2).** As in Fig. 37. Length of DHS 10, 0.040–0.050; DHS 11, 0.090–0.095; ratio DHS 10/11, 0.42–0.56. Metanotum with 17–21 (16–19) marginal setae.

Tergal setae: II, 19–24 (19–22); III, 17–22 (17–19); IV, 17–20 (15–18); V, 17–20 (15–16); VI, 18–19 (13–17). Total setal number on tergites I–VII, 114–138 (105–125). Postspiracular setae very long, 0.40, on II, IV and VIII; long, 0.29, on I; short, 0.14–0.18, on III, V and VI, and very short, 0.08–0.09, on VII. Sternal setae: 4–5 (4) in each aster, II, 17–21 (15–16) marginal setae between asters, 11 (6–7) anterior; III, 21–25 (16–24); IV, 27–30 (21–24); V, 29–34 (21–27); VI, 24–27 (18–22); VII, 20 (15–17); VIII–IX, 21–23 (22–25) including 11–12 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Dimensions: HL, 0.25 (0.27); MW, 0.39–0.41 (0.37); AW, 0.53 (0.50); ANW, 0.18–0.19; TL, 1.33 (1.27).

**Male (n = 2).** Tergal setae: II, 16 (11–14); III, 16 (13–14); IV, 15 (13–14); VII, 9 (8). Sternal setae: 4–5 (4) in each aster, 16 (10–12) marginal setae between asters, II, 10 (5–7) anterior; III, 20 (12–17); IV, 26 (16–23); V, 28 (19–23); VI, 25 (17–22); VII, 19 (14–15); sternites III–VII without medioanterior setae. Dimensions: HL, 0.23 (0.25–0.26); PW, 0.22 (0.23); MW, 0.29 (0.32); TL, 1.09 (1.12); GW, 0.09; GSL, 0.07–0.08.

### Tapanti NP, Sector Cerro de la Muerte

**Female (n = 5).** As in Fig. 35. Length of DHS 10, 0.055–0.065; DHS 11, 0.105–0.120; ratio DHS 10/11, 0.46–0.62. Metasternal plate with 7–9 setae, metanotum with 19–21 (16–19) marginal setae. Femur III with 14–16 (11–12) setae in ventral setal brush.

Tergite I enlarged with convex posterior margin, but not tapering. Tergites II–V compressed by tergite I, but not too narrow (Fig. 21 vs. Fig. 38 in Clay 1966, and Fig. 36 vs. Fig. 38). Tergal setae, I, 24–27 (14–21); II, 23–26 (19–22); III, 24–26 (17–19); IV, 21–23 (15–18); V, 21–24 (15–16); VI, 19–22 (13–17); VII, 11–17 (12); VIII, 8–9 (8). Total setal number on tergites I–VII, 143–165 (105–125 or 105–138 if specimens from Braulio Carrillo are included). Postspiracular setae extremely long, 0.40–0.43, on II, IV; very long, 0.35–0.37, on VIII; long, 0.25–0.27, on I; short, 0.14–0.16, on III, V and VI, and very short, 0.08–0.10, on VII. Sternal setae: II, 4–5 (4) in each aster, 16–23 (15–16) marginal setae between asters, 9–13 (6–7) anterior; III, 24–28 (16–24); IV, 30–37 (21–24); V, 27–37 (21–27); VI, 27–32 (18–22); VII, 17–22 (15–17); VIII–IX, 24–27 (22–25) including 14–15 (11–14) setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternite VI slightly arched (Fig. 21). Anal fringe formed by 28–34 dorsal and 25–35 ventral setae. Dimensions: TW, 0.39–0.41 (0.39); HL, 0.26–0.28 (0.27); MW, 0.39–0.42 (0.37); AW, 0.49–0.58 (0.50); ANW, 0.19–0.21; TL, 1.29–1.40 (1.27).

**Male (n = 5).** Length of DHS 10, 0.055–0.060; DHS 11, 0.095–0.100; ratio DHS 10/11, 0.55–0.63. Metasternal plate with 6 setae, metanotum with 12–14 (10–12) marginal setae.

Tergal setae: I, 14–17 (9–12); II, 15–16 (11–14); III, 15 (13–14); IV, 14–16 (13–14); V, 15–16 (11–13); VI, 13–14 (11–12); VII, 8–10 (8). Postspiracular setae: extremely long (0.38–0.40) on II, IV and VIII; long (0.19–0.21) I and VII; and short (0.10–0.12) on III, V and VI. Sternal setae: II, 3–4 (4–5) in each aster, 14–16 (10–12) marginal setae between asters, 7–9 (5–7) anterior; III, 17–20 (12–17); IV, 24–25 (16–23); V, 23–30 (19–23); VI, 21–26 (17–22); VII, 15–17 (14–15); without medioanterior setae on sternites III–VII. Genital sac sclerite with a relatively large subapical projection on each side and a slightly concave posterior margin, with short darker medioposterior line (Fig. 22). Dimensions: TW, 0.35–0.37 (0.36); HL, 0.25 (0.26); PW, 0.21–0.23 (0.23); MW, 0.30–0.34 (0.32); AW, 0.40–0.42 (0.39); TL, 1.09–1.12 (1.12); GW, 0.09–0.10; GSL, 0.08.

### *Myrsidea simplex* Ansari, 1956

*Myrsidea simplex* Ansari, 1956: *Pak. J. Health*, 5: 168, Fig. 5.

**Type host:** *Catharus fuscater mentalis* Scaler & Salvin, 1876—Slaty-backed Nightingale-Thrush

**Material studied.** Two females, 3 males, ex *Catharus fuscater*, COSTA RICA: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 2–10 August 2009, Literak and Sychra leg. Deposited in INBio (O.Sychra CR211–212) and MMBC (O.Sychra CR213); 2 females and 2 males, ex *Catharus aurantiirostris*, COSTA RICA: Braulio Carrillo National Park, Sector Barva (10°07'N, 84°07'W; 2600 m), 2 August 2010, Sychra and Literak leg. Deposited in INBio (O.Sychra CR214–215); 1 male and 1 female ex *Catharus aurantiirostris*, COSTA RICA: Zona Protectora Las Tablas, La Amistad Lodge (8°54'N, 82°47'W; 1300 m), 21 August 2010, Sychra and Literak leg. Deposited in MMBC (O.Sychra CR216); 2 females, ex *Catharus mexicanus*, COSTA RICA: Rincon de la Vieja National Park, Sector Santa Maria, Sendero del Padre (10°46'N, 85°18'W; 800 m), 24 August 2009, Literak and Sychra leg. Deposited in INBio (O.Sychra CR217).

**Remarks.** This is the first record of chewing lice from *Catharus aurantiirostris* and the second species of *Myrsidea* from *Catharus mexicanus*. Our specimens differ from the redescription of *M. simplex* presented by Clay (1966) by setal counts and dimensions as follows [setal counts and dimensions mentioned by Clay (1966) are in parentheses]:

**Female (n = 7).** Length of DHS 10, 0.040–0.045; DHS 11, 0.100–0.110; ratio DHS 10/11, 0.36–0.45 (0.38–0.42). Metasternal plate with 6–7 setae.

Postspiracular setae extremely long, 0.45–0.48, on II, IV and VIII; long, 0.30, on I, and short, 0.11–0.20, on III, V, VI and VII. Sternites III–VII without medioanterior setae. Anal fringe formed by 35–39 dorsal and 34–37 ventral setae.

**Male (n = 6).** Length of DHS 10, 0.040–0.045; DHS 11, 0.090–0.100; ratio DHS 10/11, 0.40–0.50. Metasternal plate with 5–7 setae. With median gap in each tergal setal row. Postspiracular setae as for female. Sternites III–VII without medioanterior setae.

### Comparisons of females from each host species:

**ex** *Catharus fuscater* (Lafresnaye, 1845)—Slaty-backed Nightingale-Thrush (**n = 2**)

As in Fig. 30. Metanotum with 12–14 (16–18) marginal setae. Tergal setae: VII, 9–12 (8–11). Sternal setae: II, 7–8 (5) anterior; III, 25–28 (13–15); IV, 35–37 (24–30); V, 33–35 (22–29); VI, 30–31 (20–27); VII, 25 (8–12); VIII–IX, 27–29 (23–27) including 15–16 (12–15) setae on vulval margin. Dimensions: TW, 0.47–0.48 (0.45–0.47); PW, 0.28–0.29 (0.26–0.28); MW, 0.48–0.49 (0.42); AW, 0.54–0.59 (0.53); ANW, 0.22–0.23; TL, 1.47–1.49 (1.50).

**ex** *Catharus aurantiirostris* (Hartlaub, 1850)—Orange-billed Nightingale-Thrush (**n = 3**)

Metanotum with 14–15 (16–18) marginal setae. Tergal setae: III, 19–22 (22–24); IV, 21–23 (23–27); V, 19–20 (22–27); VII, 10–12 (8–11). Sternal setae: II, 10 (5) anterior; III, 19–20 (13–15); V, 27–31 (22–29); VII, 18–20 (8–12); VIII–IX, 22–24 (23–27) including 12–14 setae on deeply serrated vulval margin. Dimensions: TW, 0.43–0.44 (0.45–0.47); HL, 0.27–0.29 (0.29–0.30); PW, 0.25 (0.26–0.28); MW, 0.42–0.43 (0.42); AW, 0.50–0.53 (0.53); ANW, 0.21–0.22; TL, 1.37–1.41 (1.50).

**ex** *Catharus mexicanus* (Bonaparte, 1856)—Black-headed Nightingale-Thrush (**n = 2**)

Tergal setae: III, 18–20 (22–24); IV, 20–22 (23–27); V, 19 (22–27). Sternal setae: II, 19–20 (14–16) marginal setae between asters, 9–11 (5) anterior; III, 21–22 (13–15); IV, 30–33 (24–30); V, 29–33 (22–29); VII, 16–18

(8–12). Dimensions: TW, 0.44–0.45 (0.45–0.47); PW, 0.27–0.29 (0.26–0.28); MW, 0.43–0.44 (0.42); AW, 0.51–0.52 (0.53); ANW, 0.20–0.21; TL, 1.37–1.38 (1.50).

#### Comparisons of males from each host species:

##### *ex Catharus fuscater* (**n** = 3)

As in Fig. 34. Metanotum with 11 (12) marginal setae. Tergal setae: I, 10–11 (10); II, 12–13 (15); III, 14–15 (17–18); IV, 15–16 (14); V, 13 (15); VI, 14 (11); VII, 8 (9). Sternal setae: II, 14 (15) marginal setae between asters, 7 (9) anterior; III, 22 (17); IV, 29–30 (27); V, 29–33 (26); VI, 27–28 (25); VII, 17–22 (15); VIII, 8–11 (8). Dimensions: TW, 0.40–0.43 (0.42); HL, 0.28–0.29 (0.27); PW, 0.26–0.27 (0.25); MW, 0.36–0.37 (0.32); AW, 0.44–0.45 (0.42); TL, 1.21–1.26 (1.22); GW, 0.10–0.11; GSL, 0.08.

##### *ex Catharus aurantiirostris* (**n** = 3)

Metanotum with 8–10 (12) setae on posterior margin. Tergal setae: I, 12 (10); II, 14–15 (15); III, 15–17 (17–18); IV, 13–15 (14); V 13–14 (15); VI 11–13 (11); VII, 8–9 (9); VIII, 6 (8). Sternal setae: II, 14–15 (15) marginal setae between asters, 6–8 (9) anterior; III, 15–19 (17); IV, 23–31 (27); V, 26–27 (26); VI, 25–26 (25); VII, 16–19 (15). Dimensions: TW, 0.38–0.39 (0.42); HL, 0.26–0.27 (0.27); PW, 0.24–0.25 (0.25); MW, 0.31–0.33 (0.32); AW, 0.40–0.41 (0.42); TL, 1.12–1.17 (1.22); GW, 0.10; GSL, 0.08.

#### *Myrsidea tapanti* Sychra and Kounek sp. nov.

(Figs 23–24, 28, 32)

**Type host:** *Catharus fuscater* (Lafresnaye, 1845) – Slaty-backed Nightingale-Thrush

**Female (n = 4).** As in Fig. 28. This species belongs to the *thoracica* species group sensu Clay (1966). Length of DHS 10, 0.035; DHS 11, 0.105–0.110; ratio DHS 10/11, 0.32–0.33. Gula 4–5 setae on each side. Metasternal plate with 6 setae, metanotum enlarged, with 18–23 marginal setae. Femur III with 14–17 setae in ventral setal brush.

Abdomen with tergite I enlarged. Tergites I–IV with medioposterior convexity (Fig. 23); wide median gap in the rows of tergal setae presented on IV–VIII. Tergal setae: I, 25; II, 29–31; III, 31–33; IV, 31–33; V, 26–29; VI, 20; VII, 12; VIII, 8. Postspiracular setae extremely long (0.42–0.49) on II, IV and VIII; long (0.25–0.30) on I, III and VII; short (0.15) on V, and very short (0.08–0.10) on VI. Sternal setae: II, 4–5 in each aster, 19–20 marginal setae between asters, 4–5 anterior; III, 18–22; IV, 36; V, 33–35; VI, 27–31; VII, 25; VIII–IX, 26–28 including 14–16 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternites V–VI strongly arched (Fig. 23). Anal fringe formed by 35–40 dorsal and 33–35 ventral setae. Dimensions: TW, 0.46–0.50; HL, 0.29; PW, 0.28–0.29; MW, 0.49–0.51; AW, 0.59–0.60; ANW, 0.21; TL, 1.47–1.49.

**Male (n = 4).** As in Fig. 32. Length of DHS 10, 0.030–0.035; DHS 11, 0.100–0.105; ratio DHS 10/11, 0.29–0.35. Gula with 5 setae on each side. Metasternal plate with 6–7 setae. Metanotum with 14–15 marginal setae.

Tergal setae: I, 16–17; II, 20; III, 19–21; IV, 17–19; V, 17; VI, 13–15; VII, 10; VIII, 8. Postspiracular setae: extremely long (0.45) on II and IV; long (0.19–0.25) on I and VII; and somewhat shorter (0.10–0.12) on V. Sternal setae: II, 4 in each aster, 16 marginal setae between asters, 7–11 anterior; III, 21–26; IV, 31–39; V, 32–37; VI, 30–31; VII, 23–24; VIII, 9–13; with medioanterior setae on sternites III, 1; IV, 2; V, 1; VI, 2. Genital sac sclerite short, with a relatively large subapical projection on each side, a concave posterior margin, and without medioposterior line (Fig. 24). Dimensions: TW, 0.40–0.42; HL, 0.24–0.26; PW, 0.26; MW, 0.36; AW, 0.43–0.44; TL, 1.17–1.22; GW, 0.10–0.11; GSL, 0.07–0.08.

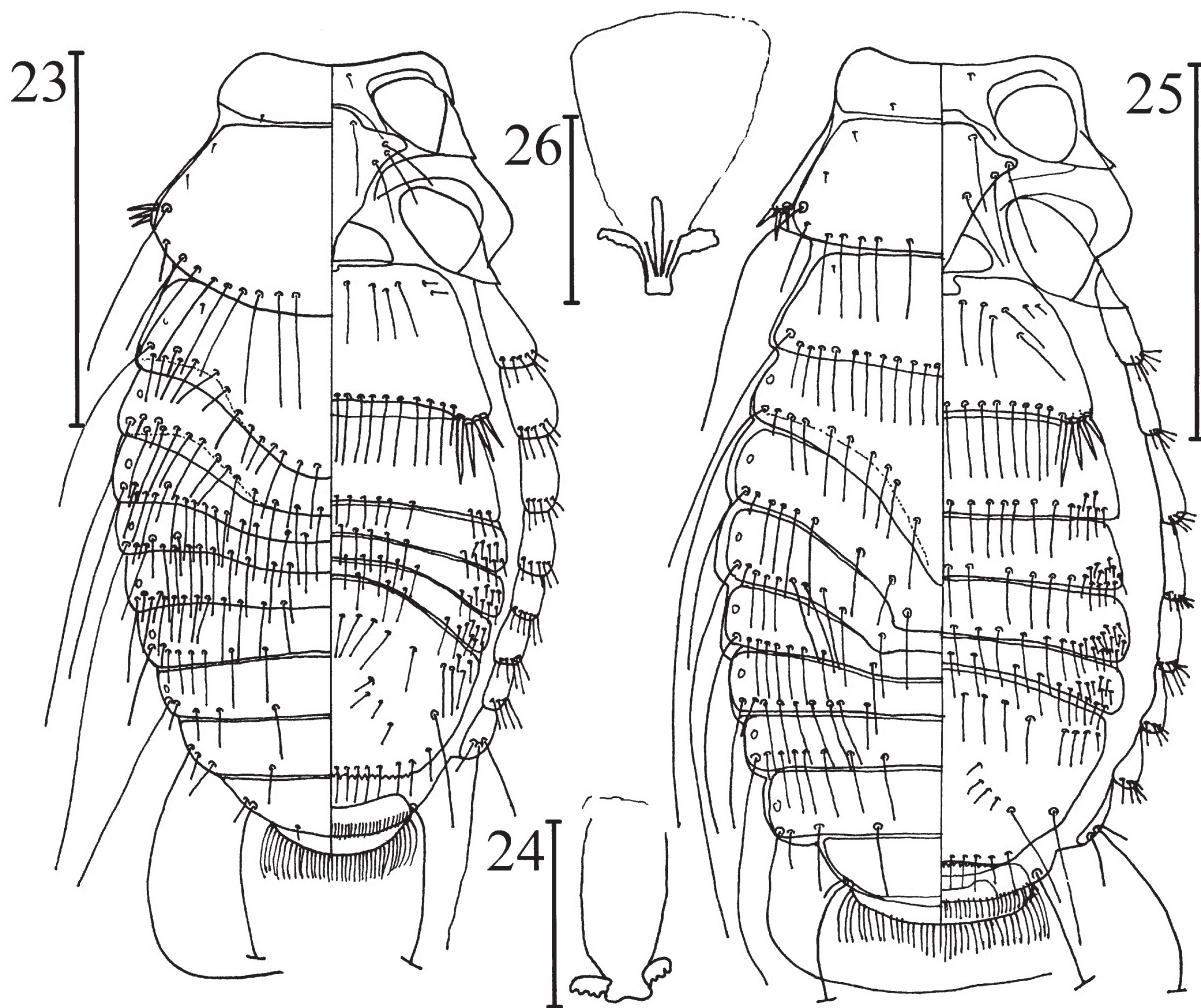
**Type material.** Female holotype and paratype male (O.Sychra CR218), ex *Catharus fuscater*, COSTA RICA: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 2–10 August 2009, Literak and Sychra leg. Paratypes: 3 females and 3 males with the same data as holotype. Deposited in INBio (O.Sychra CR218–221).

**Remarks.** This is the second species of *Myrsidea* from *Catharus fuscater*. The female of *M. tapanti* sp. nov. is clearly distinguished from those of other species belonging to the *thoracica* species group by the following characters: (1) enlarged metanotum, (2) unique shape of tergites I–II (Fig. 23), (3) continuous rows of tergal setae on I–III.

The male of *M. tapanti* sp. nov. is well characterized by its genital sac sclerite (Fig. 24), which places this species close to three species from Turdidae: *M. rohi* Ansari, 1956, *M. simplex* Ansari, 1956 and *M. varia* Ansari,

1956. However, the male of *M. tapanti* sp. nov. can be distinguished from the aforementioned species by its larger number of setae on tergites II–III (19–21 vs. 11–18); and on tergites II–V, together with 73–77 setae vs. 48–65.

**Etymology.** The species epithet derives from the name of the type locality of this new species: Tapanti National Park.



**FIGURES 23–26.** 23–24, *Myrsidea tapanti*: 23, female dorsoventral mesothorax, methathorax and abdomen. 24, male genital sac sclerite. 25–26, *Myrsidea tapetapersi*: 25, female dorsoventral mesothorax, methathorax and abdomen. 26, male genital sac sclerite. Scale bars = 0.5 mm for all figures.

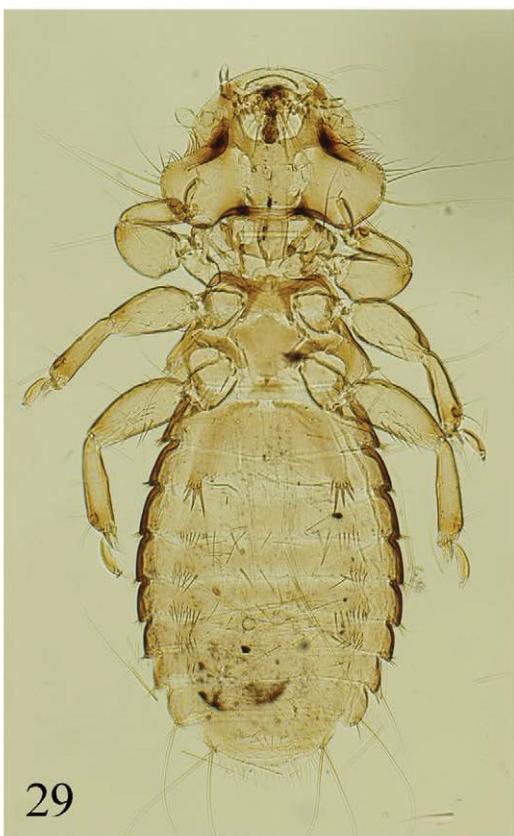
#### *Myrsidea tapetapersi* Sychra and Kounek sp. nov.

(Figs 25–26, 29, 33)

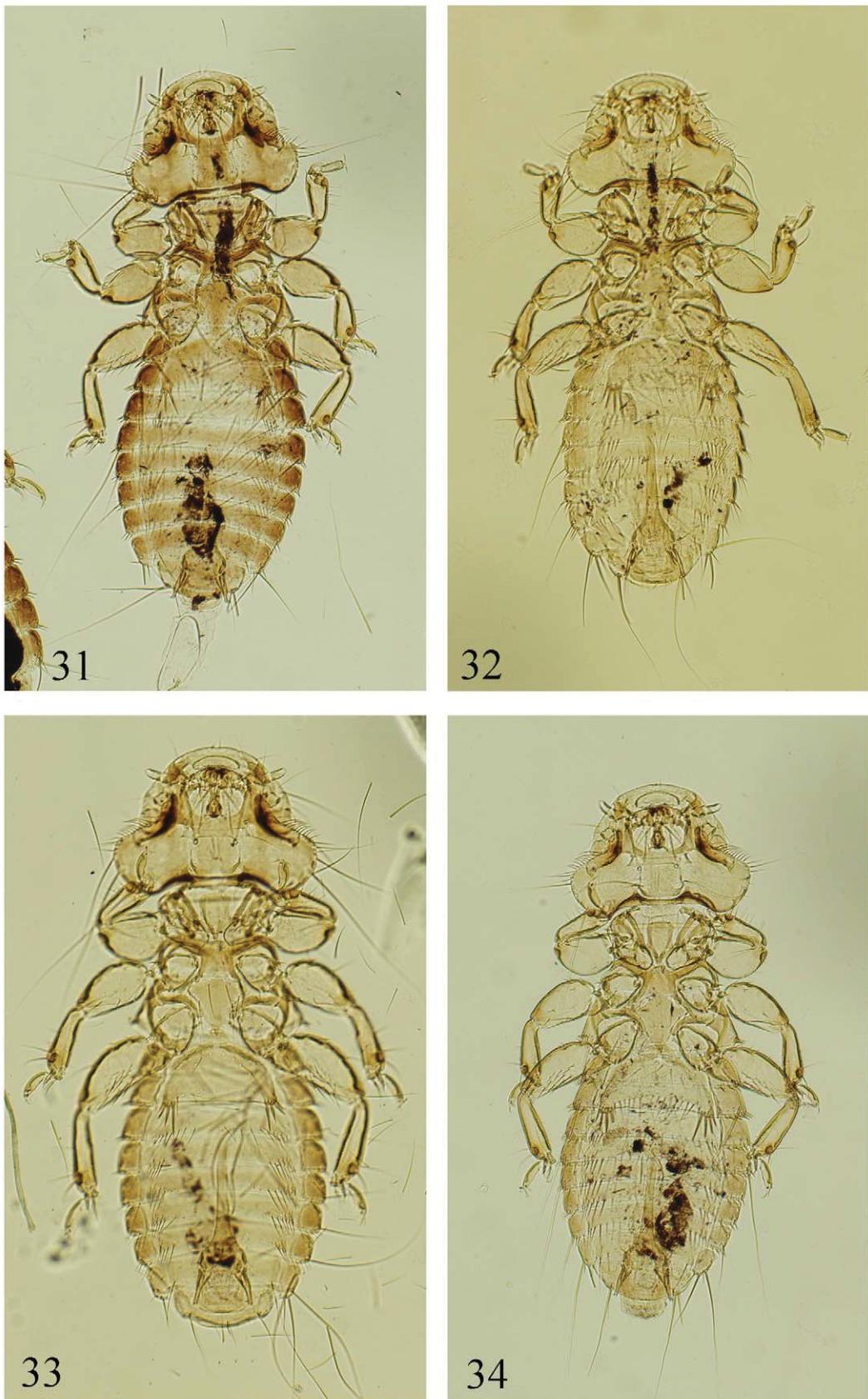
**Type host:** *Turdus nigrescens* (Cabanis, 1861)—Sooty Thrush.

**Female (n = 2).** As in Fig. 29. This species belongs to the *thoracica* species group sensu Clay (1966). Length of DHS 10, 0.075–0.085; DHS 11, 0.110–0.120; ratio DHS 10/11, 0.63–0.77. Gula with 5 setae on each side. Metasternal plate with 7 setae, metanotum not enlarged, with 13 marginal setae. Femur III with 18–22 setae in ventral setal brush.

Abdomen with tergite I not enlarged, with slightly convex posterior margin. Tergite II enlarged, with strongly convex and pointed posterior margin, tergites III and IV with concave lateral margins and straight medioposterior margins, tergite V only slightly convex (Fig. 25). Tergal setae, with median gap in each row except in tergite I: I, 24; II, 23; III, 19; IV, 17; V, 20; VI, 21; VII, 16; VIII, 8. Postspiracular setae extremely long (0.50–0.56) on II, IV, VII and VIII; very long (0.38) on I; long (0.28) on III; and somewhat shorter (0.19–0.21) on V and VI. Sternal setae: II, 4 in each aster, 17 marginal setae between asters, 10 anterior; III, 23; IV, 31; V, 40; VI, 33; VII, 13;



**FIGURES 27–30.** 27–29, holotype females: 27, *Myrsidea quinchoi*. 28, *Myrsidea tapanti*. 29, *Myrsidea tapapersi*. 30, female of *Myrsidea simplex* ex *Catharus fuscater*.



**FIGURES 31–34.** 31–33, paratype males: 31, *Myrsidea quinchoi*. 32, *Myrsidea tapanti*. 33, *Myrsidea tapetapersi*. 34, male of *Myrsidea simplex* ex *Catharus fuscater*.



35



37



36



38

**FIGURES 35–38.** 35–36: *Myrsidea rohi* Ansari, 1956 from Cerro de la Muerte (Tapanti NP): 35, female. 36, detail of tergites of female. 37–38, *Myrsidea rohi* Ansari, 1956 from Barva (Braulio Carrillo NP): 37, female. 38, detail of tergites of female.

VIII–IX, 26 including 15–16 setae on deeply serrated vulval margin; without medioanterior setae on sternites III–VII. Sternite VI arched (Fig. 25). Anal fringe formed by 48 dorsal and 38 ventral setae. Dimensions: TW, 0.53; HL, 0.33–0.34; PW, 0.31; MW, 0.49; AW, 0.59–0.63; ANW, 0.21–0.25; TL, 1.58–1.65.

**Male (n = 4).** As in Fig. 33. Length of DHS 10, 0.070–0.075; DHS 11, 0.105–0.115; ratio DHS 10/11, 0.61–0.71. Gula with 4–5 setae on each side. Metasternal plate with 8 setae, metanotum with 11–12 marginal setae.

Tergal setae, with median gap in each row: I, 18; II, 17–18; III, 15–17; IV, 16–18; V, 17; VI, 15; VII, 11–12; VIII, 7–8. Postspiracular setae extremely long (0.50–0.52) on II, IV and VIII; very long (0.40) on VII; long (0.30) on I and III; and somewhat shorter (0.16–0.25) on V and VI. Sternal setae: II, 4 in each aster, 15 marginal setae between asters, 7–8 anterior; III, 18–21; IV, 27–28; V, 30–33; VI, 29; VII, 15–18; VIII, 7; without medioanterior setae. Genital sac sclerite with a large subapical projection on each side, a straight or slightly convex posterior margin and with short, dark medioposterior line (Fig. 26). Dimensions: TW, 0.48–0.49; HL, 0.31–0.32; PW, 0.28–0.29; MW, 0.39–0.41; AW, 0.50; TL, 1.39–1.42; GW, 0.11–0.12; GSL, 0.08.

**Type material.** Holotype female and paratype male (O.Sychra CR222), 1 female and 3 males paratypes (O.Sychra CR223–224) ex *Turdus nigrescens* COSTA RICA: Tapanti National Park, Sector Cerro de la Muerte (9°33'N, 83°43'W; 3100 m), 12–14 August 2010, Sychra and Literak leg. Deposited in INBio (O.Sychra CR222–223) and MMBC (O.Sychra CR224).

**Remarks.** This is the first record of a chewing louse from *Turdus nigrescens*. The female of *M. tapetapersi sp. nov.* is clearly distinguished from those of other species belonging to the *thoracica* species group by the unique shape of its tergites (Fig. 25).

The male of *M. tapetapersi sp. nov.* is characterized by the following features: (1) genital sac sclerite, (2) tergal chaetotaxy, and (3) sternites III–VII without anterior setae and quite large dimensions. These characters place *M. tapetapersi sp. nov.* close to *M. keniensis* Clay, 1966 from *Turdus abyssinicus* Gmelin, 1789 from Kenya. However, the male of *M. tapetapersi sp. nov.* can be distinguished by its larger number of setae on tergite I (18 vs. 12–13) and sternites IV–V (35–37 vs. 27–33).

**Etymology.** This species is named in honor of Oldrich Sychra Sr, father of the corresponding author, who is also known by his nickname TapeTapers.

## Discussion

This paper includes the first records of chewing lice from 4 of the 10 bird species examined, i.e. *Catharus aurantiirostris*, *Catharus frantzii*, *Myadestes melanops* and *Turdus nigrescens*. Also, two species of *Myrsidea*—*M. antiqua* and *M. simplex*—are recorded for the first time from Costa Rica (see Table 1).

Among the species of *Myrsidea* studied in this paper, the material of the four previously described species differed slightly, particularly in setal counts and dimensions, from original descriptions or redescriptions. Our data increase knowledge of intraspecific morphological variability in these species.

Furthermore, this paper records two new host-louse associations for previously known species of *Myrsidea*, i.e. *Catharus aurantiirostris* and *C. mexicanus* for *M. simplex*. The host-louse association between *M. simplex* and *C. mexicanus* in Costa Rica is of interest because this bird species also hosts *M. destructor* Ansari, 1956 in Mexico, on the subspecies *C. mexicanus mexicanus* (Bonaparte, 1856), while in Costa Rica the host subspecies is *C. mexicanus fumosus* Ridgway, 1888.

Until now, only three species of birds belonging to the Turdidae (*Turdus grayi*, *T. fumigatus* Lichtenstein, 1823, and *T. nudigenis*) had been found as hosts of two different species of *Myrsidea* (Price *et al.* 2003). We have added 3 further host species to that category: *Catharus gracilirostris*, *C. mexicanus* and *C. fuscater* (see Table 1, Price *et al.* 2003). In the case of *Turdus grayi*, its two subspecies from different geographic locations were known to host two different species of *Myrsidea*, with one louse species on each host subspecies, i.e.: *M. antiqua* on *T. grayi grayi* Bonaparte, 1838, from eastern Mexico to Guatemala, and *M. carrikeri* from *T. grayi casius* (Bonaparte, 1855), from Costa Rica to northwest Colombia (Clay 1966; Clements *et al.* 2011). However, our results show that *M. antiqua* also occurs on *T. grayi casius*, the only subspecies of *T. grayi* present in Costa Rica (Clement & Hathaway 2000; Del Hoyo *et al.* 2005). On the other hand, *M. simplex* was originally described from *C. fuscater mentalis* from Peru, which occurs in the southeast Andes of Peru and northwest Bolivia, while *Catharus fuscater hellmayri* Berlepsch, 1902 lives in the mountains of Costa Rica and west Panama (Clements *et al.* 2011).

The fact that *Myrsidea simplex* parasitises three species of *Catharus* (*C. aurantiirostris*, *C. fuscater* and *C. mexicanus*) can be explained by the close phylogenetic relationships of the hosts, as well as by their sympatry and similar habitat preference (Bueter *et al.* 2009). Conversely, the type series of *M. tapanti sp. nov.* from *C. fuscater* (probably *C. fuscater hellmayri*) and *M. cerrodelamuertensis sp. nov.* from *C. gracilirostris* were collected in Costa Rica at the same sites where other species of *Myrsidea* were collected: *M. simplex* from *C. fuscater* and *M. rohi* from *C. gracilirostris* (Table 1). This is consistent with Price *et al.* (2008) who recorded a case of two different species of *Myrsidea* co-occurring on the same individual bird. These results suggest that either a recent successful host-switching event or a duplication event occurred on these hosts (Johnson & Clayton 2003). Moreover, another example is probably represented by the population of *M. rohi* from Cerro de la Muerte that differs morphologically from that from Barva (see Remarks section for this species). One explanation could be the distribution of *C. gracilirostris*, which is very common in the highlands from 2200 m a.s.l., but which occurs in a few isolated populations in the highest parts of Costa Rica's mountains (e.g., Barva, Cerro de la Muerte, or Irazu – the type locality of *M. rohi*) (Garrigues & Dean, 2007). Such an allopatric geographical distribution can be equated to that of separate islands, and their isolation may lead to geographically isolated subspecies of lice (e.g. Palma & Price 2010).

Lindell *et al.* (2002) presented parasitological parameters of chewing lice from *T. grayi* (*M. carrikeri*) and *T. assimilis* (*Myrsidea* sp., most likely *M. assimilis* *sp. nov.*) from the Zona Protectora Las Tablas of Costa Rica (at sites quite close to where the type series of *M. assimilis* was collected). Our results conflict with those reported by Lindell *et al.* (2002). We found significant lower prevalences (P) and mean intensities (MI) for both species: (1) for *M. carrikeri*, P = 46% and MI = 3.8, against P = 79% and MI = 30.6 in Lindell *et al.* (2002); (2) for *M. assimilis*, P = 23% and MI = 5.3, against P = 77% and MI = 18.1 in Lindell *et al.* (2002). One possible explanation for the low number of lice found in this study could be methodological differences, although Clayton & Drown (2001) have shown that the fumigation-chamber method, which we used, yields comparable results to the dust-ruffling method used by Lindell *et al.* (2002). Therefore, we think that the marked differences in the incidence of chewing lice between our study and that of Lindell *et al.* (2002) might be explained by the time of year when the sampling was carried out: ours in August versus February–June in the case of Lindell *et al.* (2002). Chewing lice populations are known to increase in spring as a result of the onset of their hosts' breeding period (Price *et al.* 2003). While the period chosen by Lindell *et al.* (2002) corresponds to the pre-breeding and breeding seasons for both bird species (Clement & Hathway 2000; Lindell *et al.* 2002), we examined birds during the post-breeding period, and that may be the reason for the prevalences and mean intensities being lower. Despite there being no papers dealing with population dynamics of chewing lice from Central America (or even the Neotropical Region), we argue that these results provide some evidence of seasonal dynamics among tropical chewing lice. Further collections and study of chewing lice from Neotropical passerines are needed to test this hypothesis.

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## References

- Ansari, M.A.R. (1951) Mallophaga (Amblycera) infesting birds in the Panjab (India). *Proceedings of the National Institute of Sciences of India*, 17, 127–203.
- Ansari, M.A.R. (1956) A contribution to our knowledge of *Myrsidea* (Mallophaga: Amblycera) occurring on Turdidae (sens. lat.). *Pakistan Journal of Health*, 5, 163–177.
- Bueter, C., Weckstein, J., Johnson, K.P., Bates, J.M. & Gordon, C.E. (2009) Comparative phylogenetic histories of two louse genera found on *Catharus* thrushes and other birds. *Journal of Parasitology*, 95, 295–307. <http://dx.doi.org/10.1645/GE-1642.1>
- Clay, T. (1966) Contributions towards a revision of *Myrsidea* Waterston I. (Menoponidae: Mallophaga). *Bulletin of the British Museum (Natural History) Entomology*, 17, 327–395.
- Clayton, D.H. & Drown, D.M. (2001) Critical evaluation of five methods for quantifying chewing lice (Insecta: Phthiraptera). *Journal of Parasitology*, 87, 1291–1300. [http://dx.doi.org/10.1645/0022-3395\(2001\)087\[1291:CEOFMF\]2.0.CO;2](http://dx.doi.org/10.1645/0022-3395(2001)087[1291:CEOFMF]2.0.CO;2)
- Clement, P. & Hathway, R. (2000) *Thrushes*. Christopher Helm, London. 429 pp.
- Clements J.F., Schulenberg T.S., Iliff M.J., Sullivan B.L., Wood C.L. & Roberson D. (2011) The Clements checklist of birds of the world: Version 6.6. Available from <http://www.birds.cornell.edu/clementschecklist/downloable-clements-checklist> (Accessed 25 July 2012).
- Del Hoyo, J., Elliott, A. & Christie, D. (eds.) (2005) *Handbook of the Birds of the World. Vol. 10: Cuckoo-shrikes to Thrushes*. Lynx Edicions, Barcelona. 668 pp.
- Garrigues, R. & Dean, R. (2007) *The Birds of Costa Rica*. Christopher Helm, London, 387 pp.
- Johnson, K.P. & Clayton, D.H. (2003) Coevolutionary history of ecological replicates: Comparing phylogenies of wing and body lice to Columbiform hosts. Pp. 262–286. In: Page, R.D.M. (Ed.) *Tangled Trees: Phylogeny, Cospeciation, and Coevolution*. The University of Chicago Press, Chicago. 350 pp.
- Kounek, F., Sychra, O., Capek, M., Lipkova, A. & Literak, I. (2011a) Chewing lice of the genus *Myrsidea* (Phthiraptera: Menoponidae) from the Cardinalidae, Emberizidae, Fringillidae, and Thraupidae (Aves: Passeriformes) from Costa Rica, with descriptions of four new species. *Zootaxa*, 3032, 1–16.
- Kounek, F., Sychra, O., Capek, M. & Literak, I. (2011b) Chewing lice of the genus *Myrsidea* (Phthiraptera: Menoponidae) from New World warblers (Passeriformes: Parulidae) from Costa Rica, with description of four new species. *Zootaxa*, 3137, 56–63.
- Lindell, C.A., Gavin, T.A., Price, R.D. & Sanders, A.L. (2002) Chewing louse distributions on two Neotropical thrush species. *Comparative Parasitology*, 69, 212–217. [http://dx.doi.org/10.1654/1525-2647\(2002\)069\[0212:CLDOTN\]2.0.CO;2](http://dx.doi.org/10.1654/1525-2647(2002)069[0212:CLDOTN]2.0.CO;2)
- Palma, R.L. & Price, R.D. (2010) The species of *Myrsidea* Waterston (Insecta: Phthiraptera: Menoponidae) from the Galapagos Islands, with descriptions of new taxa. *Tuhinga – Records of the Museum of New Zealand Te Papa Tongarewa*, 21, 135–146.
- Price, R.D., Hellenthal, R.A. & Palma, R.L. (2003) World checklist of chewing lice with host associations and keys to families and genera. Pp. 1–448. In: Price, R.D., Hellenthal, R.A., Palma, R.L., Johnson, K.P. & Clayton D.H. (Eds.) *The Chewing Lice: World Checklist and Biological Overview*. Illinois Natural History Survey Special Publication, 24, 1–501.
- Price, R.D., Johnson, K.P. & Dagleish, R.C. (2008) Five new species of *Myrsidea* Waterston (Phthiraptera: Menoponidae) from saltators and grosbeaks (Passeriformes: Cardinalidae). *Zootaxa*, 1873, 1–10.
- Sychra, O., Literak, I., Capek, M. & Havlicek, M. (2006) Chewing lice (Phthiraptera) from typical antbirds and ground antbirds (Passeriformes: Thamnophilidae, Formicariidae) from Costa Rica, with descriptions of three new species of the genera *Formicaphagus* and *Myrsidea*. *Zootaxa*, 1206, 47–61.
- Uchida, S. (1926) Studies on amblycerous Mallophaga of Japan. *Journal of the College of Agriculture*, Tokyo, 9, 1–56.